India

Neutral *(no change)*

Aerospace & Defence

India's air defence tech stuns the world

- AFNET revolutionized IAF's communication capabilities, replacing outdated tropo-scatter system, enabling real-time data sharing for **net-centric warfare**.
- IACCS integrates diverse data sources to provide a **real-time air situation picture**, enhancing situational awareness and a rapid response to threats.
- India's air defence arsenal, with five **S-400 squadrons,** indigenous systems like Akash, blends advanced imports and local tech for a multi-layered shield.

Enabling network-centric warfare for Indian Air Force with AFNET

The Air Force Network, launched on 14th Sep 2010, by then Defence Minister A.K. Antony, has been a cornerstone of the Indian Air Force or IAF's modernization efforts, fundamentally transforming its operational capabilities in the digital age. **By replacing the inefficient 1950s-era tropo-scatter system, which was limited by slow data rates, high spectrum usage, and inability to support modern warfare's data demands, AFNET provides a secure, high-speed communication grid that connects critical operational assets across India's vast geography**, including command and control centres, offensive aircraft like MiG-29s, Rafales, and Sukhoi Su-30s, sensor platforms such as ground-based radars and AWACS, and missile batteries like the advanced S-400 Triumf.

IACCS is a force multiplier for India's air defence

The Integrated Air Command and Control System (IACCS) serves as the central nervous system of India's air defence, orchestrating a cohesive response to aerial threats across the nation's expansive airspace. **By fusing data from a diverse array of sources—including ground-based radars (both homogeneous and heterogeneous), airborne platforms like AWACS and drones, manual reports from observation posts scattered across strategic locations, and inputs from fighter aircraft and missile batteries—IACCS delivers a real-time Recognized Air Situation Picture (RASP) that empowers commanders with unparalleled situational awareness for swift decision-making and precise asset deployment.** Its seamless integration with AFNET ensures compatibility across the IAF's diverse inventory, from legacy systems like the Pechora SAM to modern assets like Rafale jets and S-400 systems, while also facilitating joint operations with the Indian army and navy, thus creating a unified defence posture that can tackle multi-domain threats with efficiency.

India's lethal air defence arsenal

India's air defence arsenal stands as a formidable shield, seamlessly integrating advanced imported systems like the **Russian S-400 Triumf—capable of engaging threats up to 400km and altitudes of 30–35km, with the ability to track 300 targets simultaneously and engage 36 at once—with indigenous systems such as the Akash, which intercepts targets at 45km with Mach 3.5 precision and is deployed across eight IAF squadrons and two army regiments on platforms like T-72, BMP-2, and Tata trucks.** This multi-layered grid, meticulously designed to counter a spectrum of aerial threats, encompasses long-range systems like the Prithvi Air Defence, which intercepts ballistic missiles at 80km altitude as part of the Indian Ballistic Missile Defence Programme, medium-range systems like the Barak-8, offering a versatile 100km range and deployed in strategic regions like Ladakh to counter Chinese threats, and short-range systems like the Israeli SPYDER, which provides quick-reaction defence with Python-5 and Derby missiles up to 50km, with one squadron in service and four more on order. The arsenal is further enhanced by very short-range systems like the 9K35 Strela-10, with a 5km range, and the upgraded L-70 anti-aircraft guns, modernized with electro-optical fire control systems, X-band radar, and auto-tracking to counter radar-evading drone swarms, with over 1,000 units inducted so far in 2025, making it a cornerstone of India's point defence, especially in the context of India-Pakistan tensions.

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Introduction of AFNET in 2010

The Air Force Network (AFNET) is a cornerstone of the Indian Air Force's (IAF) modernization efforts, enabling it to function as a network-centric air force capable of addressing modern aerial threats. Launched on 14th Sep 2010, by then Defence Minister A.K. Antony, AFNET represents a significant technological leap from the outdated communication systems of the past.

What is AFNET?

AFNET is a secure, digital information grid owned, operated, and managed by the IAF. It serves as a high-speed communication network that connects critical operational assets, including command and control centres, offensive aircraft (such as MiG-29s, Rafales, and Sukhoi Su-30s), sensor platforms (radars and surveillance systems), and ground missile batteries (like Akash and S-400). Developed in collaboration with Indian companies HCL Technologies and Bharat Sanchar Nigam, AFNET was designed to support the IAF's transition to net-centric warfare, where real-time data sharing and coordination are paramount.

The network was inaugurated with a demonstration of its capabilities, where MiG-29 jets simulated the interception of enemy targets, showcasing real-time coordination on large screens at the IAF auditorium. This event marked AFNET's role in enhancing operational efficiency and situational awareness, positioning the IAF among global leaders in network-enabled air forces.

Replacement of the tropo-scatter communication system

Prior to AFNET, the IAF relied on a tropo-scatter communication system established in the 1950s. This system used the earth's troposphere to scatter radio signals, enabling long-distance communication without line-of-sight. While innovative for its time, the tropo-scatter system had significant limitations by the 21st century:

- **Inefficiency:** It was slow and unable to handle the high data volume required for modern warfare.
- **Spectrum usage:** It occupied substantial 2G and 3G spectrum bandwidth, which could have been allocated to civilian wireless communications, thus hindering national telecommunication growth.
- **Obsolescence:** The technology was outdated compared to modern digital communication systems, limiting the IAF's ability to integrate advanced sensors and weapons.

AFNET's introduction addressed these shortcomings by replacing tropo-scatter with a state-of-the-art digital network. This transition not only improved military communication but also freed up valuable spectrum for civilian use, aligning with the government's 'Network for Spectrum' initiative, which aims to balance defence modernization with national telecommunication growth.

How AFNET works?

AFNET operates as a robust digital information grid that facilitates seamless, real-time communication and data sharing across the IAF's operational ecosystem. Its architecture is designed to integrate diverse assets and ensure secure, high-speed connectivity. Key components of AFNET's operation include:

Network infrastructure

- AFNET is built on a high-speed digital backbone, leveraging fibre optic and satellite communication technologies to ensure reliable connectivity across India's vast geography.
- It was developed in collaboration with HCL Technologies, which provided technological expertise, and BSNL, which contributed to telecommunications infrastructure, ensuring integration with national networks.

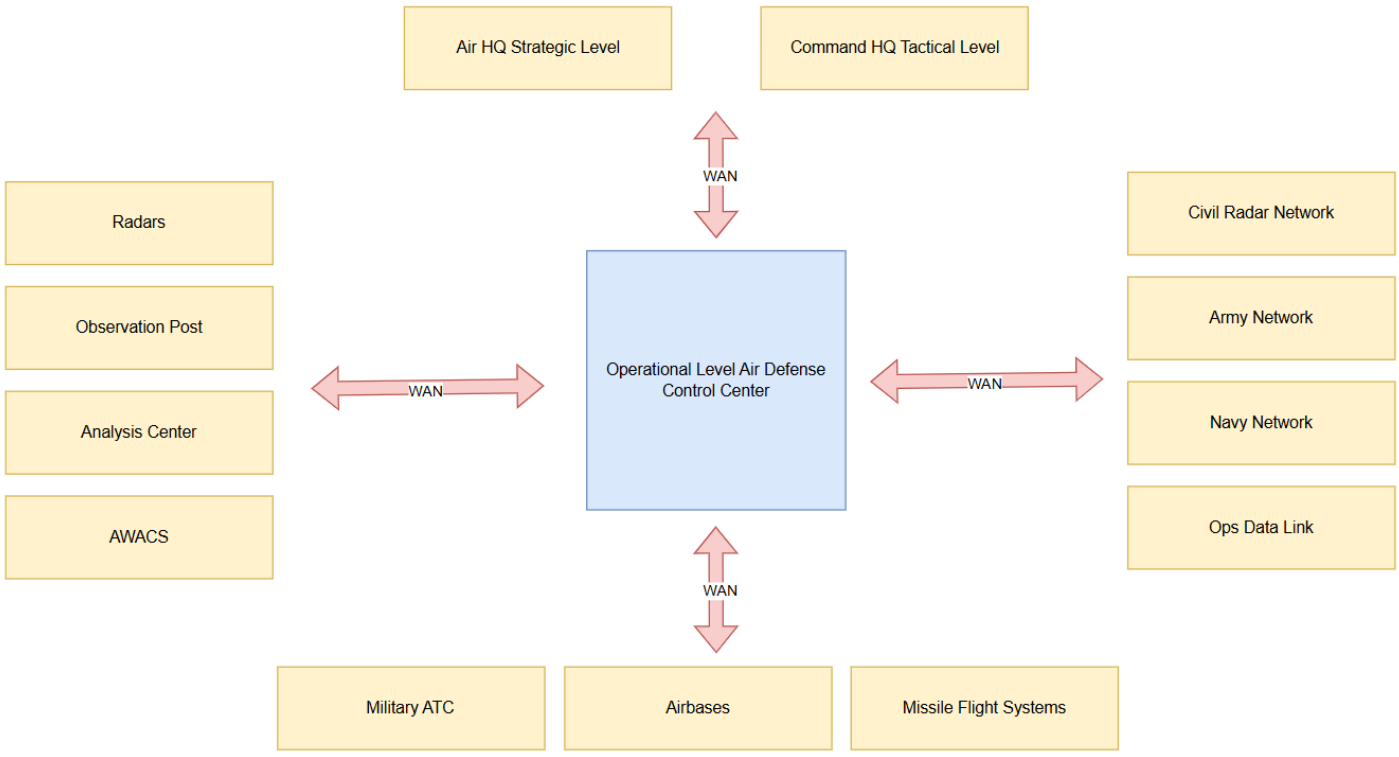
Asset integration

- **Command and control centres:** These serve as the central hubs for decision-making, receiving and processing data from all connected assets.
- **Offensive aircraft:** Fighter jets and other aircraft are linked to AFNET, receiving real-time mission updates and targeting data.
- **Sensor platforms:** Radars, airborne warning and control system (AWACS), and other surveillance systems feed data into the network, enabling comprehensive situational awareness.
- **Ground missile batteries:** Air defence systems, such as Akash, MRSAM, and S-400, are integrated for coordinated threat response.

Security architecture

- AFNET employs a 'Defence in Depth' strategy, incorporating multiple layers of security to protect against cyber threats.
- **Advanced encryption technologies:** These ensure that communications are secure and resistant to eavesdropping or manipulation.
- **Intrusion prevention systems:** These actively monitor the network for unauthorized access attempts, safeguarding data integrity.

Figure 1: Integrated Air Command and Control System structure



SOURCE: INCRED RESEARCH

Integrated Air Command and Control System (IACCS)

The Integrated Air Command and Control System (IACCS) is a pivotal component of India's air defence architecture, acting as the central nervous system for managing the nation's airspace. Established in 2003, IACCS builds on the foundation laid by the Air Force Network (AFNET) to integrate and coordinate air defence assets across the Indian Air Force (IAF), Army, and Navy. By leveraging AFNET's secure, high-speed communication grid, IACCS ensures real-time situational awareness and rapid response to aerial threats.

What is IACCS?

IACCS is an automated, network-centric air defence system designed to enhance India's ability to detect, track, and neutralize aerial threats, including aircraft, missiles, and drones. Conceived in response to challenges identified in battlespace management during the late 1990s, the Directorate of IACCS was established in 2003, with Group Captain Ramamoorthy Venkatasubramanian as its first Commanding Officer. The system was proposed for procurement in 1999, with plans to acquire five IACCS nodes to cover India's airspace comprehensively.

IACCS serves as a force multiplier by integrating data from diverse sources—radars, airborne warning and control system (AWACS), drones, fighter aircraft, and ground-based observation posts—to provide commanders with a unified, real-time picture of the airspace. This capability, known as the Recognized Air Situation Picture (RASP), enables rapid decision-making and effective deployment of air defence assets. IACCS's integration with AFNET has been instrumental in transforming the IAF into a modern, network-enabled force capable of addressing complex, multi-dimensional threats.

Figure 2: Integrated Air Command and Control System team

SOURCE: INCRED RESEARCH

Synergy with AFNET

The Air Force Network (AFNET), launched in 2010, is the critical enabler of IACCS's functionality. As detailed in the previous section, AFNET replaced the outdated tropo-scatter communication system with a high-speed, secure digital grid, connecting command centres, aircraft, sensors, and missile batteries. IACCS rides on this robust infrastructure, leveraging AFNET's capabilities to achieve seamless integration and coordination of air defence assets.

Key aspects of the AFNET-IACCS synergy include:

- **Real-time data sharing**: AFNET's high-speed connectivity ensures that data from heterogeneous sources, such as ground-based radars and airborne AWACS, is transmitted to IACCS nodes instantly, enabling real-time threat assessment and response.

- **Secure communication:** AFNET's advanced encryption and intrusion prevention systems protect IACCS's data flows, safeguarding against cyber threats and ensuring operational integrity.
- **Scalability:** AFNET's scalable architecture allows IACCS to integrate new assets, such as the army's Akashteer system or advanced SAMs like the S-400, without compromising performance.
- **Net-centric operations:** The combination of AFNET and IACCS enables the IAF to operate as a network-centric force, where all assets are interconnected, and decisions are driven by a shared operational picture. As Air Marshal A.K. Bharti noted, this net-centric capability is vital to modern-day warfighting.

How IACCS works

IACCS operates as a centralized command and control system that aggregates and processes data from multiple sources to provide a comprehensive view of India's airspace.

Data collection

IACCS integrates data from a wide range of sensors, including:

- **Ground-based radars:** Both homogeneous (similar types) and heterogeneous (different types) radars provide coverage across India's airspace.
- **Airborne platforms:** AWACS and drones contribute real-time surveillance data.
- **Observation posts:** Manual reports from ground-based observers supplement sensor data.
- **Other assets:** Inputs from fighter aircraft, missile batteries, and allied forces enhance the data pool.

Data fusion and processing

- The system uses advanced algorithms to fuse data from these sources, eliminating redundancies and resolving conflicts to create a unified RASP.
- The RASP is a real-time, dynamic representation of the airspace, showing the location, trajectory, and nature of all detected objects, whether friendly, hostile, or neutral.

Command and control

- The RASP is displayed at IACCS command centres, enabling commanders to assess threats and make informed decisions.
- Commands are transmitted via AFNET to air defence assets, such as fighter jets (e.g., Rafale, Sukhoi Su-30) or surface-to-air missiles (e.g., Akash, MRSAM, S-400), for rapid response.

Coordination and deployment

- IACCS coordinates the deployment of assets based on the type and urgency of the threat, ensuring optimal resource allocation.
- It supports a short sensor-to-shoot loop, minimizing the time from threat detection to neutralization.

Feedback and adaptation

- Post-mission data is analyzed to evaluate performance and refine tactics, ensuring continuous improvement in operational effectiveness.

IACCS's ability to integrate and process data in real time was showcased during Operation Sindoor, where it played a pivotal role in neutralizing Pakistani drones and missiles, preventing airspace violations.

Capabilities of IACCS

IACCS offers a range of capabilities that enhance India's air defence posture, making it a critical asset in both peacetime and conflict scenarios. These include:

Real-time situational awareness

- The RASP provides commanders with a comprehensive, real-time view of the airspace, enabling them to monitor friendly and hostile activities.
- This capability enhances situational awareness, allowing the IAF to anticipate and counter threats effectively.

Rapid decision-making and response

- By integrating data and streamlining command processes, IACCS accelerates decision-making, reducing the time required to deploy assets.
- During Operation Sindoor, IACCS enabled the swift neutralization of Pakistani PL-15 missiles and drones during 8-10 May 2025, demonstrating its effectiveness.

Integration of diverse assets

- IACCS integrates a wide range of assets, from legacy systems like the Pechora SAM to modern platforms like the S-400 and Rafale jets.
- Its ability to handle heterogeneous data sources ensures compatibility across the IAF's diverse inventory.

Support for joint operations

- IACCS facilitates coordination with the Indian Army and Navy, as well as the Border Security Force, ensuring a unified defence posture.
- The integration of the army's Akashteer system with IACCS, as noted by Army Chief General Upendra Dwivedi, is a step toward seamless inter-service collaboration.

Minimization of fratricide

- By providing a clear picture of friendly and hostile assets, IACCS reduces the risk of friendly fire, enhancing operational safety.
- This was critical during Operation Sindoor, where coordinated responses prevented confusion amidst intense aerial engagements.

Scalability and redundancy

- IACCS's architecture is designed to scale, accommodating new sensors and weapons as they are inducted.
- It incorporates redundancy to ensure operational continuity, even if specific nodes or assets are compromised.

Support for multi-layered air defence

- IACCS controls India's multi-layered air defence system, which includes inner (MANPADS, L70), short-range (QRSAM, Spyder), medium-range (Akash, MRSAM), and long-range (S-400, fighters) layers. This layered approach, coordinated through IACCS, ensures comprehensive protection against diverse threats.

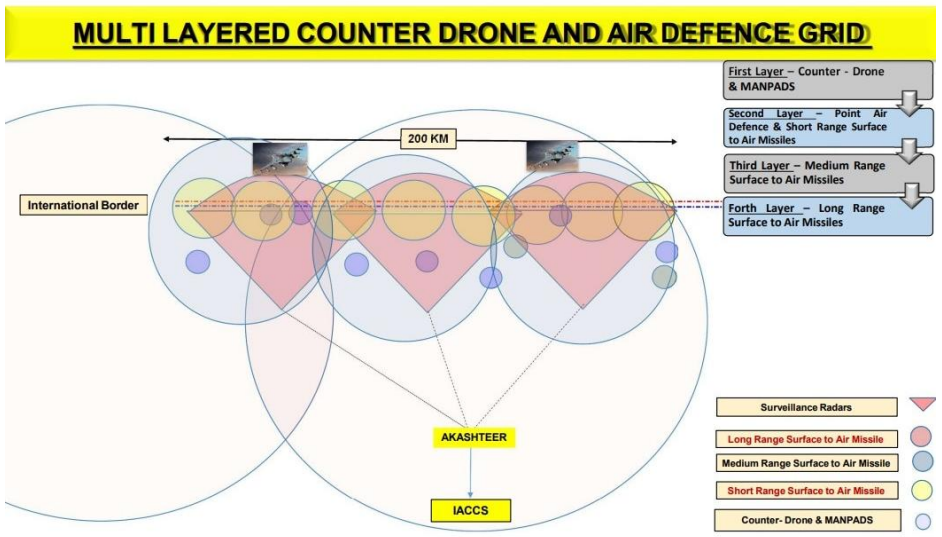
Historical performance

- IACCS's effectiveness was proven during the 2019 Balakot airstrikes, where it supported the IAF's operations and enabled the downing of a Pakistani F-16 by an Indian MiG-21.

IACCS and Akashteer integration

The integration of the army's Akashteer air defence system with IACCS is a significant milestone in India's air defence strategy. Developed by Bharat Electronics (BEL), Akashteer provides real-time data to IACCS, enhancing the army's contribution to the air defence network. Approximately 400 Akashteer command and control centres have been ordered, with 107 delivered so far in 2025 (BEL). This integration, expected to be fully operational by the end of 2025F, ensures a shorter sensor-to-shoot loop and a faster kill chain.

Figure 3: Multilayer defence with Akashteer integration

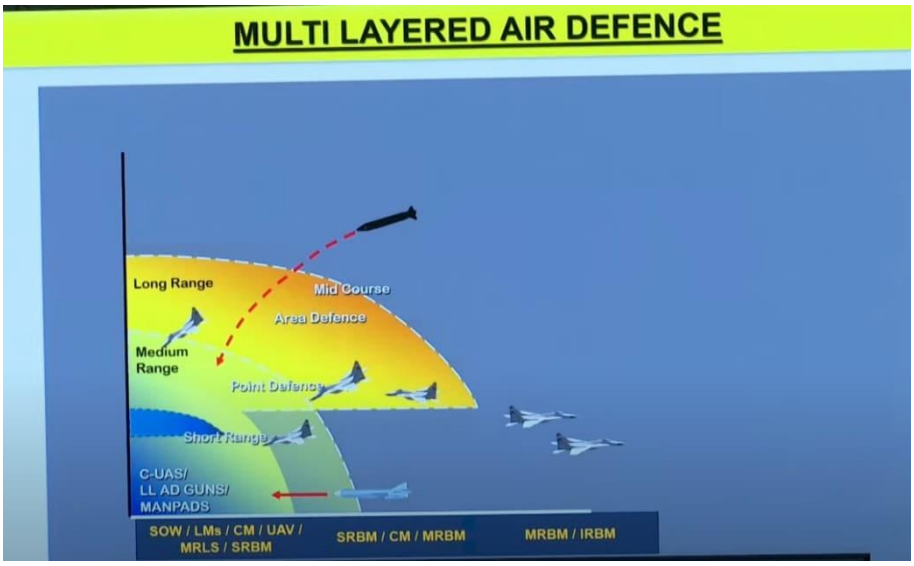


SOURCE: INCRED RESEARCH

India's air defence arsenal

India’s air defence arsenal, seamlessly integrated with the **Integrated Air Command and Control System (IACCS)** and powered by the **Air Force Network (AFNET)**, forms a comprehensive, multi-layered defence to safeguard its airspace against threats ranging from aircraft and ballistic missiles to cruise missiles, drones, and UAVs. The system combines indigenous, imported, and upgraded technologies to ensure a robust defence posture, enabling real-time coordination and response across various layers of air defence. This arsenal is designed to counter both conventional aerial threats and emerging challenges, such as drone swarms, while maintaining interoperability across India’s armed forces.

Figure 4: Multilayered air defence



SOURCE: INCRED RESEARCH

Long-range air defence system

At the strategic level, India’s long-range air defence is anchored by the **Indian Ballistic Missile Defence (BMD) Programme**, a two-tiered initiative to intercept ballistic missiles.

Prithvi air defence and advanced air defence missiles ➤

The **Prithvi Air Defence (PAD)** missile, an exo-atmospheric interceptor, operates at a range of 300–2,000km and can intercept targets at altitudes up to 80km with a speed exceeding Mach 5, using inertial navigation, Long-Range Tracking Radar (LRTR) updates, and terminal radar homing, with its first successful test in 2006. Complementing this is the **Advanced Air Defence (AAD)** missile, an endo-atmospheric interceptor with a 150–200km range and a maximum altitude of 30 km, reaching Mach 4.5, designed to neutralize threats that penetrate the PAD layer.

Figure 5: Prithvi air defence system

SOURCE: INCRED RESEARCH

Russian S-400 - Sudarshan Chakra ➤

Enhancing this capability is the **S-400 Triumf (Sudarshan Chakra)**, procured from Russia, which can detect 300 targets at 600km, engage 36 targets simultaneously, and intercept threats at ranges up to 400km and altitudes of 30–35km using missiles like the 40N6E, 48N6DM, 9M96E2, and 9M96E, capable of countering stealth aircraft and ballistic missiles at speeds up to Mach 14, with India deploying five squadrons at a cost of Rs350bn, significantly impacting adversaries' tactics, as seen with Pakistan relocating its F-16s to avoid its engagement envelope.

Figure 6: S-400 defence system

SOURCE: INCRED RESEARCH

Medium- and short-range missile system (less than 100km)

For medium- and short-range threats, India employs a variety of surface-to-air missile (SAM) systems to protect against aircraft, cruise missiles, and UAVs.

Akash air defence system

The indigenous **Akash air defence system**, with a range of 45km and a speed of Mach 3.5, uses mid-course command guidance and terminal active radar homing with a 60kg high-explosive fragmentation warhead, and is deployed across eight Indian Air Force squadrons and two army regiments on platforms like T-72, BMP-2, and Tata trucks.

Figure 7: Akash air defence system

SOURCE: INCRED RESEARCH

SPYDER system, QRSAMS and others

The Israeli **SPYDER** system, a quick-reaction defence solution, uses Python-5 (20 km) and Derby (50km) missiles with infrared and active radar guidance, supported by EL/M-2106 or EL/M-2084 radars, with one squadron currently in service and four more on order. The Soviet-era **2K12 Kub (Kvadrat)** provides a 24km range and operates at altitudes from 100 metres to 14,000 metres with semi-active radar homing at Mach 2.8. The **Barak 8 (LR-SAM/MR-SAM)**, deployed notably in Ladakh against China, offers a versatile 0.5–100km range and 16km altitude at Mach 2, using a two-way datalink and active/infrared imaging radar seeker, and is operated by the army, air force, and navy. The **QRSAM (Quick Reaction SAM)**, also deployed in Ladakh, covers a 3–30km range and 30 metre to 6km altitude at Mach 4.7, using inertial navigation, data link, and terminal active radar seeker, mounted on BEML-Tatra 8WD trucks for mobility.

Figure 8: SPYDER defence system

SOURCE: INCRED RESEARCH

Very short-range air defence (VSHORAD) system

At the tactical level, very short-range air defence system provides point defence against low-flying threats like drones and helicopters. The **9K35 Strela-10** has a 5km range and 3.5km altitude, operating at around Mach 2 with an infrared/optical seeker for guidance. The **2K22 Tunguska** combines 30mm twin cannons and eight 9M311 series SAMs, supported by integrated tracking and targeting radar, with the vehicle itself capable of speeds up to 65km/h. The **ZSU-23-4 Shilka**, a radar-guided self-propelled anti-aircraft gun with four 23mm cannons, remains in limited use by the Indian army, providing close-in defence against low-altitude threats.

Upgraded L-70 40mm anti-aircraft gun »

A critical asset in India's point defence, particularly in the context of India-Pakistan tensions, is the upgraded **L-70 40mm anti-aircraft gun**, originally developed by Sweden's Bofors and manufactured in India. Capable of firing 240–330 rounds per minute with a 4km range, it has been modernized with an **Electro-Optical Fire Control System** for improved target acquisition, an **X-band radar** for autonomous drone detection, **auto-tracking** for all-weather target acquisition, and **video tracking** for enhanced firing accuracy, making it highly effective against radar-evading drone swarms by flooding the sky with predictive fire. With over 1,000 units inducted, the L-70 is the most widely used air defence gun in India's armed forces, serving as a key front-line defence.

Integration with IACCS and AFNET

The effectiveness of India's air defence arsenal lies in its integration with the **IACCS**, which leverages the **AFNET** for real-time data sharing and coordination. Long-range systems like the S-400 and BMD provide strategic data to the Operational Level ADCC, while medium- and short-range systems like Akash, Barak 8, and QRSAM offer tactical defence. VSHORAD system and upgraded assets like the L-70 ensure point defence, creating a layered, networked approach that counters diverse threats, from ballistic missiles to drone swarms, while ensuring seamless interoperability across India's military branches.

Role of Bharat Electronics

Bharat Electronics (BEL) is a cornerstone of India's air defence system, providing critical electronic components and systems that enhance the functionality of AFNET, Integrated Air Command and Control System, Akashteer, and the multi-layered defence framework. BEL's contributions include the development of advanced radars, such as the Low-Level Transportable Radar Ashwini and Swathi Weapon Locating Radar, which supply real-time surveillance data to IACCS, enabling precise threat tracking and enhancing situational awareness. As the lead integrator for the Akash missile system, BEL manufactures phased array radars and command guidance systems, crucial for target acquisition and missile guidance, significantly boosting the medium-range defence layer's effectiveness. Additionally, BEL's Akashteer system, with 107 of 400 planned command and control centres delivered so far in 2025, integrates army air defence assets with IACCS, enhancing inter-service coordination and real-time response capabilities, as demonstrated during Operation Sindoor. BEL's communication and electronic warfare systems further support AFNET's secure, high-speed network, ensuring seamless data flow across the air defence ecosystem, solidifying India's defensive capabilities.

Role of Bharat Dynamics

Bharat Dynamics (BDL) plays a vital role in India's air defence by manufacturing missile systems that form the effector arm of the multi-layered defence structure. BDL is a primary producer of the Akash missile system, assembling and integrating the medium-range surface-to-air missile that effectively neutralized Pakistani drones and PL-15 missiles during Operation Sindoor, showcasing its reliability and precision in the medium-range layer. BDL's expertise extends to the production of the Astra beyond-visual-range air-to-air missile, enhancing the Indian Air Force's air combat capabilities within the long-range defence layer, complementing systems like the S-400. By collaborating with the Defence Research and Development Organisation or DRDO and BEL, BDL ensures that missiles like Akash are seamlessly integrated with IACCS and Akashteer, enabling rapid deployment through AFNET's high-speed communication network.

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Recommendation Framework

Stock Ratings	Definition:
Add	The stock's total return is expected to exceed 10% over the next 12 months.
Hold	The stock's total return is expected to be between 0% and positive 10% over the next 12 months.
Reduce	The stock's total return is expected to fall below 0% or more over the next 12 months.

The total expected return of a stock is defined as the sum of the: (i) percentage difference between the target price and the current price and (ii) the forward net dividend yields of the stock. Stock price targets have an investment horizon of 12 months.

Sector Ratings	Definition:
Overweight	An Overweight rating means stocks in the sector have, on a market cap-weighted basis, a positive absolute recommendation.
Neutral	A Neutral rating means stocks in the sector have, on a market cap-weighted basis, a neutral absolute recommendation.
Underweight	An Underweight rating means stocks in the sector have, on a market cap-weighted basis, a negative absolute recommendation.

Country Ratings	Definition:
Overweight	An Overweight rating means investors should be positioned with an above-market weight in this country relative to benchmark.
Neutral	A Neutral rating means investors should be positioned with a neutral weight in this country relative to benchmark.
Underweight	An Underweight rating means investors should be positioned with a below-market weight in this country relative to benchmark.